

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 9611

Roll No.

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**B. Tech.****(Semester II) Even Semester Theory Examination, 2012-13****ENGINEERING PHYSICS-II****[Total Marks : 50]****Time : 2 Hours]****Note :** Attempt questions from each Section as per instructions.**Section-A**

Attempt *all* parts of this question. Give answer of each part in about 50-75 words.  
 Each part carries 1 mark. 1×10=10

1. (a) Let a wave packet formed by a wave function  $Ae^{-ax}$ , where  $A$  is constant. Calculate the value of  $A$  by normalizing.
- (b) Define wave packet with neat diagram.
- (c) From Compton's effect, show that when photon is backscattered, the electron recoils in the direction of incident photons.
- (d) What do you mean by dielectrics? Define dielectric polarization.
- (e) Define magnetic susceptibility and magnetic permeability. Write relation between them.
- (f) What is an ultrasonic wave? Write any two methods for producing it.
- (g) What is Faradays law of electromagnetic induction? Write the expression in integral form.
- (h) Why Maxwell's proposed that Ampere's circuital law require modifications?
- (i) What do you mean by critical temperature of a superconductor? Write any two differences between Type I and Type II superconductors.
- (j) What is carbon nano-tube?

**Section-B**

Attempt any *three* parts of this question. Give answer of each part in about 100-200 words. Each part carries 5 marks. 5×3=15

2. (a) Calculate the de-Broglie wavelength of neutron at room temperature (300K) and liquid nitrogen temperature (77K).
- (b) A 50 KeV electron impinged on the slits of width 500nm separated by a distance of 2000nm. The observation screen was located 350nm beyond the slits. What was the distance between first two maxima?
- (c) At 0°C and 1 atmospheric pressure, the dielectric constant of He is 1.000074 and its atomic density is  $2.69 \times 10^{25}$  atoms/m. Calculate dipole moment in each He atom when gas is placed in electrical field strength of 1 volt/m.
- (d) Show that the value of conduction current in the wire is equal to displacement current in parallel plate capacitor if an a.c. voltage of  $V = V_0 \sin \omega t$  is connected across the parallel plate capacitor.

- (e) An ultrasonic beam is used to determine the length of swimming pool. The adjacent harmonics are separated by 50 Hz. What is the length of the pool if the velocity of ultrasonic waves in water is 1330 m/s?

### Section-C

Attempt *all* questions of this Section. Give answer of each question in 300-500 words. Each question carries 5 marks.

3. Attempt any *one* part of the following between 300-500 words :

(a) A quantum mechanical particle is moving in one-dimensional infinite potential box of width  $a$ . Derive an expression for energy and momentum of the particle.

(b) What is Compton's Effect? Derive an expression for Compton's shift

4. Attempt any *one* part of the following :

(a) Derive Clausius-Mosotti relation. In which type of solids this relation can be used?

(b) Discuss Langevin's theory of diamagnetism. Show that diamagnetic susceptibility is negative and independent of temperature and field strength.

5. Attempt any *one* part of the following between 300-500 words :

(a) Define plane electromagnetic wave. Show that the impedance for a component of electric field vibrating in  $Y$ -direction and propagating in  $X$ -direction is given by :

$$\frac{E_Y}{E_Z} = \sqrt{\frac{\mu_0}{\epsilon_0}}$$

where symbols have their usual meanings.

(b) Prove that the velocity of electromagnetic wave in vacuum is given by  $c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$ .

Calculate the value of refractive index for non-magnetic medium if electromagnetic wave is propagated through it.

6. Attempt any *one* part of the following :

(a) Explain the entropy, specific heat and isotope effect when superconducting state is achieved from normal state.

(b) What do you mean by arm chair, zigzag and chiral singlewalled nanotubes? Explain with proper neat diagram.

7. Attempt any *one* part of the following :

(a) What is piezoelectric effect? Draw a circuit diagram of piezoelectric oscillator and explain the production of ultrasonic waves using it.

(b) Define uncertainty principle. Show that for Gaussian wave packet the uncertainty in position and momentum is given by :

$$\Delta p \cdot \Delta x \geq \frac{\hbar}{2}$$

### Physical Constants :

Velocity of light  $c = 2.997 \times 10^8$  m/s

Electron rest mass  $m_e = 9.109 \times 10^{-31}$  kg.

Rest mass of neutron  $m_p = 1.674 \times 10^{-27}$  kg.

Joule  $1J = 6.242 \times 10^{18}$  eV

Planck's constant  $h = 6.6255 \times 10^{-34}$  joule sec

Rest mass of proton  $m_p = 1.6725 \times 10^{-27}$  kg.

Electron volt  $1 \text{ eV} = 1.602 \times 10^{-19}$  joule